

Lightweight Robotic Excavation, Phase II

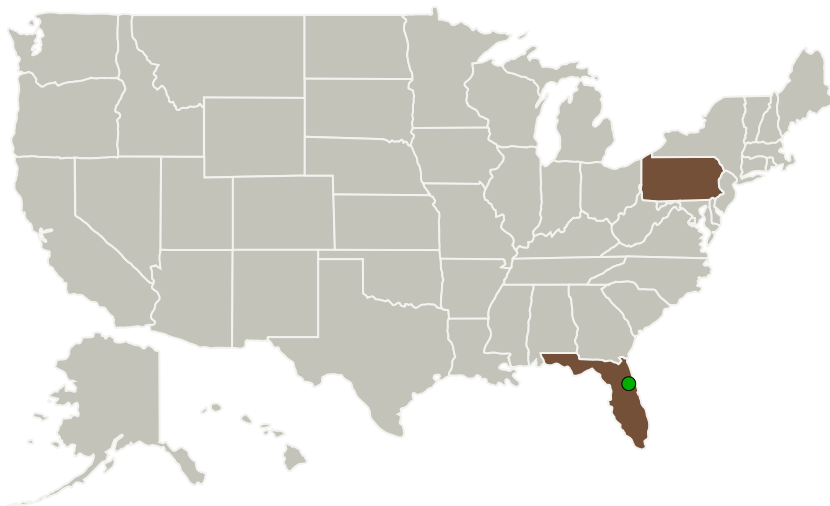
Completed Technology Project (2011 - 2014)



Project Introduction

Lightweight robotic excavators address the need for machines that dig, collect, transport and dump lunar soil. Robust and productive small robots enable mining rich and accessible deposits of ice and other volatiles buried near craters at the lunar poles, delivering resources to produce propellant, and thus making space exploration sustainable. Lightweight excavators bridge the gap between prospecting and full-scale ISRU. A lightweight robot is proposed that excavates and delivers regolith with production so superior to the state of the art as to enable realistic lunar and planetary applications. Demonstration of light weight will be achieved by operating a low mass robot in Earth gravity reduced 5/6 by offloading. The significance of the proposed innovation is an approach that not only performs the required tasks but is low in mass (30 kg to 150 kg). Mass constraints make productive excavation challenging. However, innovative designs incorporating transverse bucket-wheels, high payload composite dump beds, and high-speed driving are game changers, enabling regolith operations in low gravity. Phase 1 experimental results show that payload ratio and driving speed govern productivity of small robots. Phase 2 will elevate TRLs from 3 at the beginning to an estimated 4 or 5 at end of contract.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Astrobotic Technology, Inc.	Lead Organization	Industry	Pittsburgh, Pennsylvania
● Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations	
Florida	Pennsylvania

Project Transitions

**June 2011:** Project Start**August 2014:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/139036>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Astrobotic Technology, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

David Gump

Co-Investigator:

David Gump

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Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX04 Robotic Systems
 - └ TX04.5 Autonomous Rendezvous and Docking
 - └ TX04.5.6 Robot Control for Vehicle Capture and Berthing

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System